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Does the Inclusion of a Cost Attribute in Forced and Unforced Choices Matter? Results from a Web Survey Applying the Discrete Choice Experiment

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Abstract

The cost attribute is of particular importance in discrete choice experiments, and this study is the first to explore the effect of a cost attribute on both forced and unforced choices. Patients' preferences for organisational characteristics in general practice in Denmark are elicited, and the cost attribute is operationalised as user fees for the consultation. A representative sample of 1435 respondents from the Danish population answered the discrete choice experiment in a web-based questionnaire with a random split including/excluding the cost attribute. The two groups were asked to make both forced and unforced choices in each choice set. Our results show that in the unforced choice utility and scale parameters were not affected and the rank order remained the same when a cost attribute was included. In the forced choice the test of equal utility parameters was rejected, and rank order, marginal rates of substitution, and variance was shown to differ between the two groups. We observed that the inclusion of a cost attribute tended to change underlying choice behaviour. Evidence of potential dominant preferences was found in all splits.

Keywords: Discrete choice experiment, cost attribute, forced and unforced choice, status quo, dominant preference

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1 Introduction

Over time, stated preference methods have become well-established tools to elicit respondents' preferences for goods without a market price and for goods in markets with market failure. Especially the discrete choice experiment (DCE) has experienced great progress in the last decade because of its strong theoretical foundation and its ability to measure preferences for various aspects of a good. However, there are still many unsolved issues with respect to the design of the DCE. In different fields of research where the DCE is applied there have been investigations on how different survey designs affect outcomes. These studies have among other things been concerned with 1) the selection and number of attributes (e.g. Caussade et al. 2005, DeShazo and Fermo 2002, Hensher 2006), 2) the number of attribute levels and level ranges (e.g. Carlsson et al. 2007, Caussade et al. 2005, Mørkbak et al. 2010, Skjoldborg and Gyrd-Hansen 2003), 3) the number of alternatives (e.g. Caussade et al. 2005, DeShazo and Fermo 2002, Rolfe and Bennett 2009), 4) the number of choice sets (e.g. Bech et al. 2011, Caussade et al. 2005, Hensher et al. 2001), and 5) how, whether, and when to use forced or unforced choices (e.g. Banzhaf and Johnson 2001, Boxall et al. 2009, Brazell et al. 2006, Dhar 1997, Dhar and Simonson 2003, Kontoleon and Yabe 2003). The majority of these studies find that the design of the DCE matter. In many cases changing designs influence the marginal rates of substitution (MRS) and/or error variance.

One attribute which has received particular attention in the design of DCEs is the cost attribute. The cost attribute is of particular importance in DCEs since the cost coefficients – when interpreted as an estimate for the marginal utility of income - can be used to calculate the marginal willingness to pay (MWTP) for the other attributes included in the DCE. This is of great importance when using DCEs for policy purposes on arguments of allocative efficiency. Studies have been made investigating how the cost attribute affects preferences in a number of ways. Johnson et al. (2010) investigated the assumption of constant marginal utility of income in five DCEs and found that marginal utility often violates the theoretical expectations, probably due to respondents' use of cognitive heuristics. Hanley et al. (2005), Mørkbaket al. (2010), Ratcliffe and Longworth (2002), Ryan and Wordsworth (2000), and Skjoldborg and Gyrd-Hansen (2003) tested how different level ranges affected preferences. Four of the five studies suggested that monetary values from DCEs are sensitive to the range of monetary attributes included in the choices, while the fifth study (Hanley et al. 2005) found no significant impact on estimates of preferences or MWTP. The use of different payment vehicles has also been tested and shown to have an impact on preferences (Boonen et al. 2009, Ratcliffe 2001, Skjoldborg and Gyrd-Hansen 2003), just as the ordering of the attributes has been shown to influence the estimates, leading to a recommendation of placing the cost attribute at the bottom of the choice sets to follow a precautionary principle (Kjær et al. 2006). Carlsson et al. (2007) examined how different cost levels within the same range affected preferences, i.e. they compared a DCE with a cost attribute with varying levels to a DCE with a cost attribute with a constant positive level, and found that the different inclusions of the cost attribute not only affected preferences but also affected the ranking of the preferences. Bryan et al. (1998) and Essers et al. (2010) examined whether the inclusion of a cost attribute in the DCE affected preferences in a forced and unforced choice, respectively. Bryan et al. (1998) examined preferences for magnetic resonance imaging for the investigation of knee injuries in a forced choice DCE, where respondents indifferent to the two choice alternatives were allowed to tick both alternatives (these indifferent responses were

later omitted from the analyses). It was found that including a cost attribute in a choice task generated more missing data (not counting indifferent responses) and that the cost attribute itself was insignificant indicating that respondents in this setting were insensitive to price. Further, the MRS between the other attributes did not differ between the two splits. Essers et al. (2010) examined preferences for surgical treatment of primary basal cell carcinoma in an unforced DCE, and found that the cost attribute was significant but that the inclusion of the cost attribute did not affect preferences. None of the studies examined the effect on error variance. To the best of the authors' knowledge no other studies than the two mentioned above have examined the effect of a cost attribute on preferences by comparing DCEs with and without the inclusion of the cost attribute. In order to gain knowledge on how preferences are affected when a cost attribute is included, further research is needed.

This study contributes to the empirical literature on methodological issues related to the design of the DCE but with a novel focus. The paper examines the effect of including a cost attribute in a DCE aimed at examining preferences for organisational issues in the primary health care sector where choices are performed both as forced and unforced, i.e. DCEs with and without the status quo option. The study is the first to investigate whether the inclusion of a cost attribute affects preferences differently dependent on whether the choices are forced or unforced. This question is pertinent since both scenarios may be relevant to real-life choices and therefore to DCE designs, although the unforced choice should always be applied when opting out or choosing status quo is an option and the objective is to derive welfare measures (Lancsar and Louviere 2008, Ryan and Skåtun 2004, Viney et al. 2002). Accordingly, the objective of this study is to provide a comprehensive investigation of the effect of the inclusion of a cost attribute on preferences in forced as well as unforced choices. The effect is measured by testing for parameter equality, differences in MRS between the other attributes, the rank order of the attributes, and testing for differences in error variance.

Section 2 describes the theoretical ideals underpinning DCEs versus the empirical evidence, while section 3 describes study design and data collection. Section 4 briefly explains the econometric specifications. In section 5 our hypotheses are presented, followed by results in section 6 and discussion in section 7.

2 Theoretical Ideals versus Empirical Evidence

The DCE relies on random utility theory and Lancaster's economic theory of consumption, and is consistent with neoclassic economic theory (Lancaster 1966, Manski 1977, McFadden 1974). The individuals are assumed to act rationally and choose the alternative which gives the highest utility, and the respondents' choices are assumed to be determined by the trade-offs made between the attributes included in the choice set. Formally, the true but unobservable utility for alternative j in the choice sets (j=1,...,J) of individual i can be written as

$$U_{ij} = V_{ij}(X_{ij}, \beta) + \varepsilon_{ij} \qquad (1)$$

where V_{ij} represents the observable systematic component of utility which is the explainable proportion of the variance in utility of alternative j. The observable systematic component is a function of the attribute levels, X_{ij}, and a vector of their coefficients, β. The observable systematic component is assumed to be a linear

additive utility function. The error term, ε_{ij}, is the non-explainable proportion, representing the unobservable and random treated component. The error term captures heterogeneity in preferences, omitted explanatory variables, and other factors influencing decision making, e.g. bounded rationality or random error (Train 2003).

That respondents are willing to make trade-offs between the attributes in the DCE is an important assumption as is the axioms from the neoclassical economic theory, i.e. individuals have complete, stable and consistent preferences and the indifference curve is continuous. Following these assumptions, the relative importance of the attributes measured by the MRS should not differ when an extra (cost) attribute is included in the DCE, and the rank order of the attributes should remain the same. Therefore our *a priori* theoretically based expectation is that the inclusion of a cost attribute will not affect the relative importance of the other attributes (hypothesis 1 in section 5). This is confirmed in empirical studies by Bryan et al. (1998) and Essers et al. (2010), whereas others (e.g. Arentze et al. 2003, Bryan and Parry 2002, Caussade et al. 2005, Hensher 2006, McCullough and Best 1979) have reached different conclusions about the structural reliability when extra attributes are included. We do however expect to observe that the error variances increase when another attribute is added to the choice sets due to an increased cognitive burden (hypothesis 2 in section 5). This is confirmed in Arentze et al. (2003), Caussade et al.(2005) and in DeShazo and Fermo (2002). In the case that hypothesis 1 is rejected, we propose several tests to verify the underlying reasons for a change of preferences when the cost attribute is introduced. Firstly, if the introduction of a cost attribute alters the decision rule, preferences can be seen to differ between the DCEs with and without the inclusion of a cost attribute. This can be true if respondents have strong preferences for user fees and are not willing to trade off user fees with any of the other attributes in the DCE, i.e. if respondents exhibit lexicographic preferences where stepwise decisions are made and where focus is on the more important attributes before other attributes are considered. In this case the axiom of continuity is violated. This effect may be especially pronounced in the forced choice DCE where respondents are not able to opt out but are forced to use their lexicographic ordering and make choices between the alternatives. In this case, preferences can be expected to differ across forced and unforced choices (this is tested in hypothesis 3 in section 5). Secondly, different preferences in the DCE with and without the cost attribute can be due to the increased cognitive complexity when adding another attribute to the choice sets. Respondents may apply heuristics in order to reduce the cognitive burden. This may involve ignoring some of the information that is presented to them in order to simplify tasks.

In section 6 we explore whether it is possible to detect a change of the decision rule and/or an increase in cognitive complexity on the basis of the respondents' stated decision rules and perceived difficulties of answering the choice sets when a cost attribute is included. Further, we look at so-called dominant preference structures (Scott 2002, Bech et al. 2010) to identify respondents who consistently choose the cheapest alternative, the status quo or one of the hypothetical alternatives A or B. Clearly, such findings should be interpreted with caution since dominance is more likely to be found when respondents are presented with relatively few choice sets which is the case in this study (Lancsar and Louviere 2006).

3 Design and Data

The experiment is conducted in the context of a survey on patients' preferences for general practice in Denmark where preferences for different organisational

characteristics is examined. Apart from the cost attribute, which is operationalised as a user fee for the consultation, the other attributes included are: waiting time in the telephone, opening hours, waiting time to the appointment, distance to the general practice, waiting time in the waiting room, consultation time, and whether the general practitioner (GP) or assisting personnel performs routine tasks. In Table I an overview of attributes, attribute levels, and the expected effects of the attributes on preferences for choice of general practitioner is given. All attributes are familiar to the respondents. At the time of writing, there are no fees on standard services in general practice, but there is an ongoing debate on the issue. Denmark currently has user fees in other areas of the primary care sector such as dentists, chiropractors, and physiotherapists, and so the Danish public are used to paying out-of-pocket in similar circumstances. Therefore it was *ex ante* deemed feasible to apply the discrete choice experiment with the inclusion of a cost attribute in the context of GP services.

Two identical (except for the inclusion of the cost attribute) Bayesian efficient main effects designs were created by means of the software Ngene provided by ChoiceMetrics. Two hundred Halton draws were used to approximate the probability density function and a column based swapping algorithm was used to find the most efficient design of those available. The attributes waiting time in the telephone, opening hours, waiting time to the appointment, distance to the general practice, waiting time in the waiting room, and user fee were assumed to be uniformly distributed according to the hypotheses in Table 1 (For attributes assuming to generate negative utility the upper and lower bounds were [-1;0]; for attributes with an expected positive sign upper and lower bounds were [0;1]), while consultation time and routine tasks were assumed to follow a normal distribution with a positive and a negative mean of +/-0.5, respectively. 16 choice sets were created ensuring sufficient degrees of freedom and the design was blocked into four by minimising the average correlation between the blocking column and the attribute columns (ChoiceMetrics 2009).

The survey was initiated with a number of introductory questions about the respondents' use of and satisfaction with their GP and questions about attitudes towards user fees in general practice. Hereafter, the DCE was introduced and each respondent received four choice sets. For each choice set, respondents were first asked to make a forced choice followed by an unforced choice. This dual response technique is argued to be a valuable approach, especially if there is a possibility of a large number of status quo choices (Brazell et al. 2006), which was expected in this survey due to transaction costs associated with choosing a new GP and fear of the unknown. In the present context both the forced and unforced choices represent realistic scenarios. Individuals may be forced to choose a new GP if their current GP reallocates or retires, or if they themselves move to a new area. At the same time individuals always have the option of choosing a new GP should they wish to do so. Figure 1 shows an example of a choice set with the inclusion of the cost attribute. After the DCE respondents were asked to answer questions of how difficult they perceived the answering of the choice sets and about their decision rule, i.e. whether they focused on one or more attributes in their answers or just chose randomly. Respondents where afterwards presented with another DCE not reported in this study, questions about quality of life using the EQ-5D approach together with follow up questions about the respondents health and personal characteristics. Information on respondents' current GPs was elicited for all attributes included in the DCE. Unfortunately, the quality of the responses to this question was low. Due to many "Don't know" responses and response categories, which do not resemble the levels in the DCE (e.g. "I don't phone my GP"), it was decided to exclude the detailed information on status quo from the analysis. This is not expected to

Table 1. Attributes, Attribute Levels, and Hypotheses

Attributes	Description	Attribute levels (effects coding)	Hypotheses
Telephone	Typical waiting time in the telephone when you call the GP	1 minute 5 minutes 15 minutes 30 minutes	-
Opening hours	Opening hours (besides from normal opening hours)	No extended opening hours (-1) Open in Saturdays (1)	+
Appointment	Typical waiting time to the appointment (with a non acute problem)	Same day 3 days 1 week 2 weeks	-
Distance	Distance to the general practice	1 kilometre 5 kilometres 15 kilometres 30 kilometres	-
Waiting room	Typical waiting time in the waiting room	5 minutes 10 minutes 20 minutes 30 minutes	-
Consultation time	Average time allocated to the consultation	5 minutes 10 minutes 20 minutes 30 minutes	+
Routine tasks	Who performs routine tasks (e.g. blood samples, tests for allergies, vaccination)	General practitioner (-1) Nurse (1)	-
User fee	The price you have to pay for the consultation[a]	0 DKK / 0 EUR 50 DKK / 6.72 EUR 150 DKK / 20.16 EUR 400 DKK / 53.75 EUR	-

[a] The exchange from DKK to EUR is undertaken using the average May 2010 exchange rate of 744.16 (www.danskebank.dk 2010).

influence results since respondents are randomly allocated to the two splits with and without the cost attribute, which means that status quo GP characteristics should be identical across splits. That randomisation is successful across splits is confirmed using chi-squared tests for independence.

A pilot study with 28 respondents was conducted which lead to minor changes. Among these the most important was a reduction in the number of choice sets from eight to four (since many respondents stated that eight choice sets were too many, that they got confused, lost perspective, and could not distinguish the choice sets from each other). The questionnaire was sent out in May 2010 in a web based survey with a random split including/excluding the cost attribute. A representative sample with respect to age, gender, and geography of 1435 respondents from the Danish population above the age of 18 was collected. The target sample size was 1400 respondents who were recruited from an internet panel where members received an email with a link to the questionnaire. The link was deactivated when the quota was met. The respondents' characteristics are reported in Table AI in Appendix A. That respondents' are all members of an internet panel creates possibilities of bias through panel effects (Couper

Imagine that your GP has decided to close his/her practice, and that you have the possibility to choose between two other GPs, GP A and GP B.

Which GP would you prefer?

	GP A	**GP B**
Typical waiting time in the telephone when you call	15 minutes	1 minute
Opening hours (besides from normal opening hours)	Open in Saturdays	No extended opening hours
Typical waiting time to the appointment (with a non acute problem)	3 days	2 weeks
Distance to the general practice	5 kilometres	15 kilometres
Typical waiting time in the waiting room	20 minutes	10 minutes
Average time allocated to the consultation	5 minutes	30 minutes
Who performs routine tasks (e.g. blood samples, tests for allergies, vaccination)	General practitioner	Nurse
The price you have to pay for the consultation[a]	0 DKK / 0 EUR	150 DKK / 20.16 EUR

I choose: GP A □ GP B□

Now imagine that your GP has decided not to close his/her practice anyway and that you hereby have the opportunity to choose between the two GPs A and B and your current GP. Which GP would you prefer now?

I choose: My current GP □ GP A □ GP B□

[a] The exchange from DKK to EUR is undertaken using the average May 2010 exchange rate of 744.16 (www.danskebank.dk 2010).

Figure 1. Example of a Discrete Choice Question with the Inclusion of a Cost Attribute

2000). However, 89 percent of the Danish population have internet access in their own homes (Statistics Denmark 2010) and many elderly people are computer literate. Coverage error is therefore not a major problem in Denmark.

4 Modelling Approach

Assuming that the error terms in equation (1) are independent and identically distributed (iid) extreme value random variables, a conditional logit (CL) model, which is a computationally convenient model because of its closed form, can be specified.

$$P_{ij} = \frac{e^{\mu X_{ij}\beta}}{\sum_{j=1}^{J} e^{\mu X_{ij}\beta}} \qquad (2)$$

where μ is the scale parameter which is inversely related to the error variance. The scale parameter entails that attribute weights in DCEs are not directly comparable. It is possible to measure the relative impact of the attributes by calculating the MRS given that a linear additive function is appropriate. In the CL model, the error variances are assumed to be constant across individuals. To take account of heterogeneity in the scale parameter, a heteroscedastic conditional logit (HCL) model can be used, where the variance of unobserved factors are allowed to vary over individuals. In the HCL model, the source of variance can be tested, i.e. it is possible to test whether the inclusion of a cost attribute affects error variances (see e.g. DeShazo and Fermo 2002, Hensher et al. 1998, Hole 2006 and Train 2003). Models are estimated in Stata 10 using the clogit and clogithet[1] commands.[2]

5 Hypotheses and Analyses

Following the objective of the study, three hypotheses are tested. Hypotheses 1 and 2 will be meticulously treated with the forced choice as base case while results from the unforced choice will be presented more briefly under hypothesis 3.

Hypothesis 1: *MRS and rank order of attributes are unaffected by the inclusion of a cost attribute.*

This is tested in three ways. Firstly, the test of equal parameters (Swait and Louviere 1993) is used to investigate parameter equality between the two groups of respondents who received a DCE with and a DCE without a cost attribute, respectively. Secondly, the rank orders of the attributes for the two groups are compared. Thirdly, comparisons of the MRS matrices from the two groups are made. Standard errors are estimated by the delta method (Hole 2007).

Hypothesis 2: *Error variance increases when a cost attribute is included.*

[1] The Stata command clogithet is written by Arne Risa Hole, see Hole (2006).

[2] Analyses were also performed with less restrictive models, i.e. the (heteroscedastic) error component model and the (heteroscedastic) random parameter logit model. However, for the purpose of this study the heteroscedastic error component model was found inappropriate since the specified model only allowed for differences in scale (i.e. variance) of the error components across the two groups of respondents. Thus when we wish to test for heteroscedasticity between the two groups of respondents, this is only tested on the error components as opposed to e.g. the conditional logit model and the heteroscedastic random parameters logit model where scale is allowed to vary for the utility parameters, see Greene 2007. The specification of the heteroscedastic error component model thus entails that the likelihood ratio test of equal parameters (see section 5) is much more likely to be rejected. The random parameter logit model was found appropriate but due to a limited amount of respondents who chose between the two hypothetical alternatives in the unforced choice DCE, it was only possible to run random parameter logit analyses for the forced choice DCE. Since results from the random parameter logit and the conditional logit model in forced choice DCE come to the same conclusions, it was decided to be consistent and report results from the conditional logit model for both forced and unforced choices. However, results for the forced choice random parameter logit model are available upon request.

This hypothesis is tested using a HCL model that investigates whether the variance across the two groups differ. A HCL model is estimated for which the scale parameters for the attributes in the DCE with and without a cost attribute are allowed to vary.

> Hypothesis 3: *The effect on preferences is the same across forced and unforced choices when a cost attribute is included.*

This is investigated by testing for parameter equality, and exploring the rank order and MRS together with error variance for the unforced choice using the same approaches as described under hypotheses 1 and 2. Afterwards conclusions are made regarding whether there are differences in the effect of a cost attribute's inclusion in forced and unforced choices.

Following the testing of these hypotheses section 6.4 looks more detailed into which behavioural changes that can be observed across the study arms. Focus is on changes in cognitive burden (indicated by how difficult respondents perceived the choice tasks), decision rules (as indicated by respondents) as well as patterns in dominant preferences.

6 Results

6.1 Hypothesis 1

Four CL models are presented in Table II. The full model includes all observations from the forced choice DCE, while the next two models provide separate estimates for the groups receiving DCEs with and without a cost attribute. The fourth model is a HCL model, where scale is allowed to differ across the two DCEs with and without a cost attribute. The goodness of fit statistics show that all four models have extremely good model fits with all pseudo R^2 being above 0.2 (Louviere et al. 2000). In the full models all model coefficients except for routine tasks were statistically significant with the expected signs. The likelihood ratio (LR) test of equal parameters across the groups receiving DCEs with and without user fees rejects that parameters are equal in the case of forced choice on a five percent significance level.

In Table 3 the rank orders of the attributes are shown. It is seen that the rank orders of the attributes in the forced choice with and without a cost attribute are very different.

Preferences are explored more carefully by means of the calculation of MRS matrices in Table 4, where MRS is calculated for the attributes within the two splits (with and without user fees). These are reported above and below the diagonal. For example, the MRS (telephone / appointment) equals -0.451 in the group with user fees and -0.263 in the group without user fees, but these are not statistically significantly different. The reported MRS estimates reveal that a statistically significant difference in the MRS (waiting room / consultation time) can be observed with an MRS of 0.047 in the forced choice without user fees compared to a MRS of 0.814 in the forced choice with user fees. Differences are also found for the inverse MRS (waiting room / telephone), (waiting room / appointment), and (waiting room / distance) not reported in the table. No other statistical differences are found in the MRS although several MRS values appear to differ in magnitude across the DCEs which include and exclude the cost attribute. Lack of statistical significance is due to the large standard errors on the attributes (especially the insignificant ones).

Table 2. Estimation Results from Conditional Logit Models for Forced Choice (standard error)

	Full model		With user fee		Without user fee		Heteroscedastic model		
Parameters									
Telephone	-0.023	(0.002)***	-0.016	(0.003)***	-0.032	(0.003)***	-0.028	(0.003)	***
Opening hours	0.055	(0.024)**	0.098	(0.032)**	-0.014	(0.038)	0.072	(0.029)	**
Appointment	-0.062	(0.005)***	-0.062	(0.007)***	-0.071	(0.007)***	-0.075	(0.006)	***
Distance	-0.052	(0.002)***	-0.047	(0.003)***	-0.054	(0.003)***	-0.061	(0.003)	***
Waiting room	-0.011	(0.003)***	-0.018	(0.004)***	-0.001	(0.004)	-0.012	(0.003)	***
Consultation time	0.023	(0.002)***	0.022	(0.004)***	0.023	(0.004)***	0.029	(0.003)	***
Routine tasks	-0.019	(0.025)	-0.063	(0.036)	0.001	(0.037)	-0.003	(0.030)	
User fee	-0.006	(0.000)***	-0.006	(0.000)***	n.a.	(n.a.)	-0.008	(0.001)	***
ASC A	0.120	(0.032)***	0.113	(0.051)***	0.135	(0.046)***	0.155	(0.038)	***
Heteroscedasticity									
Scale (user fee = 1)							-0.378	(0.068)	***
LL(0)	-3979		-2043		-1935		-3979		
LL(Model)	-2957		-1402		-1524		-2941		
Pseudo R^2	0.257		0.314		0.212		0.261		
n (observations)[a]	11480		5896		5584		11480		
N (respondents)	1435		737		698		1435		
LR test	Equal utility parameters – df = 10 (critical $\chi^2_{0.95}$): 29.88 (18.31)								

* Explanatory power at a 0.10 significance level, ** Explanatory power at a 0.05 significance level, *** Explanatory power at a 0.01 significance level.

Table 3. Rank Order of Common Attributes in Conditional Logit for Forced Choice[a]

Attribute	With user fee	Without user fee
Telephone	7	3
Opening hours	1	4
Appointment	3	1
Distance	4	2
Waiting room	6	7
Consultation time	5	5
Routine tasks	2	6

[a] Rank orders are decided on from the MRS matrix.

In summary, hypothesis 1: *MRS and rank order of attributes are unaffected by the inclusion of a cost attribute* is rejected when respondents are forced to choose. Utility parameters differ when a cost attribute is included.

6.2 Hypothesis 2

The estimates for the HCL model are reported in Table 2. The model reveals that the respondent group presented with a DCE with a cost attribute had a statistically significant lower scale, i.e. higher variance on a five percent significance level compared to the group who did not receive a DCE with user fees (assuming equal utility parameters). Thus, hypotheses 2: *Error variance increases when a cost attribute is included* cannot be rejected on a five percent significance level for the forced choice DCE.

6.3 Hypothesis 3

Results for the CL and HCL models for unforced choice DCE are shown in Table 5. The test for equal parameters shows that both utility and scale parameters are equal across the two groups with and without a cost attribute on a five percent significance level.

Table 4. MRS Matrices for Conditional Logit Models (standard error)

		Forced choice with user fee (denominator[a])									
		Telephone	Opening hours[b, d]	Appoint-ment	Distance	Waiting room	Consulta-tion time	Routine tasks[b, d]	User fee	ASC A	ASC B
Forced choice without user fee (denominator[a])	Telephone	-	n.a.	-0.263 (0.056)	-0.350 (0.058)	-0.899 (0.215)	0.732 (0.158)	n.a.	-2.763 (0.459)	0.145 (0.074)	n.a.
	Opening hours[b, d]	n.a.	-	3.153 (1.054)	4.188 (1.374)	10.775 (4.341)	-8.768 (3.222)	n.a.	33.098 (10.923)	-1.731 (0.989)	n.a.
	Appoint-ment	-0.451 (0.060)	-0.396 (1.084)	-	-1.328 (0.178)	-3.417 (0.792)	2.781 (0.488)	n.a.	-10.498 (1.352)	0.549 (0.246)	n.a.
	Distance	-0.592 (0.072)	-0.521 (1.423)	-1.313 (0.138)	-	-2.573 (0.558)	2.094 (0.340)	n.a.	-7.904 (0.460)	0.413 (0.192)	n.a.
	Waiting room	-28.957 (114.318)	-25.469 (151.138)	-64.268 (254.291)	-48.924 (193.336)	-	**0.814**[c] **(0.180)**	n.a.	-3.072 (0.712)	0.161 (0.089)	n.a.
	Consulta-tion time	1.370 (0.292)	1.205 (3.281)	3.040 (0.492)	2.314 (0.323)	**0.047**[c] **(0.187)**	-	n.a.	3.775 (0.605)	-0.197 (0.097)	n.a.
	Routine tasks[b, d]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-21.394 (12.303)	1.119 (0.774)	n.a.
	User fee	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	0.052 (0.024)	n.a.
	ASC A	0.237 (0.080)	0.208 (0.577)	0.525 (0.179)	0.400 (0.137)	0.008 (0.032)	-0.173 (0.064)	-0.015 (0.542)	n.a.	-	n.a.
	ASC B	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-
		Unforced choice with user fee (denominator[a])									
Unforced choice without user fee (denominator[a])	Telephone	-	n.a.	-0.205 (0.088)	-0.548 (0.211)	-1.814 (1.278)	1.299 (0.848)	n.a.	-4.981 (1.801)	-0.014 (0.006)	-0.013 (0.006)
	Opening hours[b, d]	n.a.	-	5.373 (1.500)	14.401 (4.059)	47.640 (32.302)	-34.129 (17.966)	n.a.	130.858 (37.212)	0.359 (0.118)	0.351 (0.116)
	Appoint-ment	-0.271 (0.072)	4.538 (1.419)	-	-2.680 (0.645)	-8.867 (6.092)	6.352 (2.698)	n.a.	-24.355 (5.959)	-0.067 (0.018)	-0.065 (0.018)
	Distance	-0.466 (0.112)	7.807 (2.322)	-1.721 (0.369)	-	-3.308 (2.064)	2.370 (1.116)	n.a.	-9.087 (1.862)	-0.025 (0.007)	-0.024 (0.007)
	Waiting room	-2.545 (1.756)	42.654 (27.349)	-9.400 (6.860)	-5.463 (3.932)	-	0.716 (0.528)	n.a.	-2.767 (1.753)	-0.008 (0.006)	-0.007 (0.005)

Table 4. MRS Matrices for Conditional Logit Models (standard error) (cont'd)

Consulta-tion time	1.090 (0.370)	-18.263 (6.465)	4.025 (1.061)	2.339 (0.587)	0.428 (0.319)	-	n.a.	3.834 (1.808)	0.011 (0.005)	0.010 (0.005)
Routine tasks[b, d]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-86.030 (36.506)	-0.236 (0.115)	-0.230 (0.113)
User fee	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-0.003 (0.001)	-0.003 (0.001)
ASC A	-0.020 (0.007)	0.331 (0.141)	-0.073 (0.020)	-0.042 (0.011)	-0.008 (0.007)	0.018 (0.005)	0.092 (0.091)	n.a.	-	-0.976 (0.082)
ASC B	-0.016 (0.005)	0.276 (0.109)	-0.061 (0.015)	-0.035 (0.008)	-0.006 (0.005)	0.015 (0.004)	0.077 (0.076)	n.a.	-0.833 (0.070)	-

[a] MRS for the DCEs with user fees are calculated with the horizontal attributes as denominators and the vertical attributes as numerators, while MRS for the DCEs without user fees are calculated with the vertical attributes as denominators and the horizontal attributes as numerators. This is purely done for practical reasons. If the reader wants to know the inverse MRS one simply takes the inverse, i.e. 1/MRS. When exploring the inverse MRS it is found that the MRS (Waiting room / Telephone), (Waiting room / Appointment), and (Waiting room / Distance) are also different in the forced choice at a five percent significance level.
[b] MRS was multiplied by two for effects coded attributes.
[c] Significant difference between MRS for the DCE with and without user fee on a five percent significance level.
[d] MRS is only calculated for continuous attributes in the denominator.

Table 5. Estimation results from the conditional logit models for unforced choice (standard error)

	Full model		With user fee		Without user fee		Heteroscedastic model	
Parameters								
Telephone	-0.019	(0.004)***	-0.018	(0.007)***	-0.024	(0.005)***	-0.020	(0.004) ***
Opening hours	0.223	(0.042)***	0.243	(0.062)***	0.197	(0.062)***	0.224	(0.043) ***
Appointment	-0.099	(0.011)***	-0.090	(0.018)***	-0.087	(0.014)***	-0.099	(0.011) ***
Distance	-0.042	(0.004)***	-0.034	(0.006)***	-0.051	(0.006)***	-0.042	(0.005) ***
Waiting room	-0.010	(0.004)**	-0.010	(0.007)	-0.009	(0.007)	-0.010	(0.005) **
Consultation time	0.018	(0.004)***	0.014	(0.007)**	0.022	(0.005)***	0.018	(0.004) ***
Routine tasks	-0.053	(0.041)	-0.160	(0.069)**	0.055	(0.055)	-0.054	(0.041)
User fee	-0.004	(0.000)***	-0.004	(0.001)***	n.a.	(n.a.)	-0.004	(0.001) ***
ASC A	-1.220	(0.143)***	-1.352	(0.215)***	-1.194	(0.212)***	-1.221	(0.144) ***
ASC B	-1.370	(0.145)***	-1.385	(0.226)***	-1.433	(0.206)***	-1.371	(0.146) ***
Heteroscedasticity								
Scale (user fee = 1)							-0.011	(0.040)
LL(0)	-6306		-3239		-3067		-6306	
LL(Model)	-2608		-1168		-1431		-2608	
Pseudo R^2	0.586		0.639		0.534		0.586	
n (observations)[a]	17220		8844		8376		17220	
N (respondents)	1435		737		698		1435	
LR test	Equal utility parameters – df = 11 (critical $\chi^2_{0.95}$): 18.25 (19.68)							
	Equal scale parameters – df = 1 (critical $\chi^2_{0.95}$): 0.08 (3.84)							

* Explanatory power at a 0.10 significance level, ** Explanatory power at a 0.05 significance level, *** Explanatory power at a 0.01 significance level.

[a] The number of observations for the unforced choice is larger than the number of observations for the forced choice since in the forced choice only two alternatives are present (1435 respondents × 4 choice sets × 2 alternatives = 11480), while respondents are presented with three alternatives in the unforced scenario (1435 respondents × 4 choice sets × 3 alternatives = 17220).

Table 6. Rank Order of Common Attributes in Conditional Logit for Unforced Choice[a]

Attribute	With user fee	Without user fee
Telephone	5	5
Opening hours	1	1
Appointment	3	3
Distance	4	4
Waiting room	7	7
Consultation time	6	6
Routine tasks	2	2

[a] Rank orders are decided on from the MRS matrix.

The rank orders of the attributes are seen to be similar across groups (Table 6) and MRS cannot be shown to differ on any attributes in the MRS matrix (Table 4).

6.4 Additional Behavioural Results

After answering the four choice sets respondents were asked how difficult they perceived the choice tasks to be overall and what their decision rule was, i.e. whether they focused on one or more attributes or just chose randomly between the alternatives. The respondents' answers to these questions are reported in Table 7 where it is seen that the perceived difficulty does not differ statistically between respondents receiving DCEs with and without user fees. With respect to the respondents stated decision rule it is seen that in the DCE with user fees, statistically significantly more respondents state that they focus on one attribute and statistically more respondents make random choices. This suggests that adding a cost attribute does not increase perceived difficulty, but that this unaltered perception may be a result of respondents relieving themselves of a cognitive burden by either using a simplified decision rule or making random choices. Note that it is not possible to distinguish between forced and unforced choices in Table 7.

In Table 8 the presence of potential dominant preferences are explored. The pattern of dominance shows that in the forced choice there is a large difference in the proneness to consistently choosing the same alternative in the two DCEs with and without the cost attribute. When user fee is not included in the DCE, significantly more respondents (22 percent) consistently choose either option A or option B. When the cost attribute is included 37 percent of the respondents consistently choose the cheapest alternative. In the unforced choice between 80 and 67 percent of the respondents consistently choose the status quo depending on whether the cost attribute is present or not. That so many respondents consistently choose their current GP is consistent with the large proportion of respondents (89 percent) stating that they are satisfied with their current GP. It can also be shown that significantly more of the respondents who actually make hypothetical choices state that they are dissatisfied with their current GP.

When looking at the difference in patterns of dominant preferences, we can conclude that 1) consistently choosing status quo is highly prevalent in the unforced choice, and 2) consistently choosing the cheapest option is prevalent when facing a forced choice *and* a cost attribute, and 3) consistently choosing either A or B is more prevalent when the other options (i.e. choosing current or cheapest GP) are not available.

Table 7. Perceived Difficulty and Stated Decision Rule in DCE Answers

	With user fee	Without user fee
Perceived difficulty of the DCE questions		
Very difficult to answer choice questions	7.64 %	6.20 %
Difficult...	41.20 %	38.62 %
Easy...	42.02 %	45.68 %
Very easy...	9.14 %	9.51 %
Number of respondents	733	694
Stated decision rule		
My choices were guided mainly by one attribute[a]	18.28 %	11.90 %
My choices were guided mainly by two attributes[a]	48.57 %	56.02 %
Most attributes influenced my choices	24.42 %	27.14 %
My choices were mostly random[a]	8.73 %	4.93 %
Number of respondents	733	689

[a] Statistical significant difference on a 5% significance level.

Table 8. Choice Behaviour (% of observations)

	Forced choice		Unforced choice	
	With user fee	Without user fee	With user fee	Without user fee
GP A was always chosen	3.53 %	12.03 %	0 %	0.86 %
GP B was always chosen	1.63 %	10.03 %	0.41%	0.43 %
Status quo was always chosen	n.a.	n.a.	79.51 %	67.48 %
Cheapest hypothetical alternative was always chosen	36.50 %	n.a.	1.09 %	n.a.
Number of respondents	737	698	737	698

7 Discussion

The present study investigated the effect of introducing a cost attribute in a dual response DCE. The effect was examined by testing for parameter equality, and comparing rank orders, MRS, and variance across the DCEs with and without the inclusion of a cost attribute for both the forced and the unforced choice. Further it was tested whether the perceived difficulty and decision rule changed when a cost attribute was included, and the presence of potential dominant preferences was explored.

For the unforced choice, utility and scale parameters did not differ when a cost attribute was included, and the rank order remained the same. The result suggests that those respondents not choosing their current GP do not alter their rule of decision with the introduction of user fees since MRS, rank order, and variance remain unaffected. This result is in line with the findings of Essers et al. (2010). It should however be noted that the propensity to opt-out is higher (although not statistically significant at a

five percent significance level) when the cost attribute is present. This may indicate that the option of opting out replaces any other lexicographic preference structure or heuristic that could have surfaced when introducing the cost-attribute. That we cannot verify any impact on preferences across attributes may partly be due to the large proportion of respondents choosing the status quo, which reduces the variation in choices and the probability of obtaining statistically significant results. Future research might benefit from collecting larger samples when a large proportion of respondents choosing the status quo option is expected.

In contrast, for the forced choice, our results show that utility parameters are not equal, and that rank order, MRS, and variance differ across the DCEs with and without a cost attribute. This is in contrast to the findings of Bryan et al. (1998). Our results, based on respondents' self-reporting of decision rules, suggest that this observation may to some degree be explained by a change in respondents' decision rule. For some respondents, the cost attribute represents a dominant attribute and less focus is placed on other attributes. For other respondents, the inclusion of a cost attribute (or just any additional attribute) induces them to make random choices. Both explanations appear prudent since there was a significantly lower scale in the DCE with a cost attribute and 37 percent of respondents consistently chose the cheaper option.

That MRS and rank order differ in the forced choice with and without the inclusion of a cost attribute is problematic in the sense that the interpretation of the MRS is dependent on respondents making trade-offs in their choices. If respondents exclusively focus on the cost attribute or choose completely at random, the assumptions behind the DCE methodology are violated and it does not make sense to calculate MRS. Recent studies have indeed shown that attribute non-attendance is evident and if the phenomenon is taken into account, estimates of MWTP differ significantly from the MWTP obtained when all attributes are assumed to influence respondents choices (Carlsson et al. 2010, Hensher et al. 2005, Hensher and Greene 2009). In addition, evidence suggests that there are discrepancies between respondents self-reported decision rules and decision rules inferred by using econometric techniques (Carlsson et al. 2010, Ryan et al. 2009). When a Bayesian efficient experimental design is used, correlation across the attributes is permitted since the aim is to obtain as robust parameter estimates as possible, trying to minimise the variance on parameter estimates. This is not a problem as long as respondents make trade-offs since preferences converge to the true population preferences independent on the design matrix (McFadden 1974). However, if respondents deviate from using compensatory decision rules, practice might deviate from theory. If respondents' exhibit dominance for the cost attribute, correlation in the design matrix may influence parameter estimates, although this aspect of experimental designs has not yet been looked at.[3] This means that we cannot be sure that the difference in rank order and MRS is due to differences in preferences or due to correlation in the survey design if non-compensatory decision making is used. Future research should aim at exploring this further.

In trying to understand the underlying changes that occur when presenting DCEs with and without the cost attribute in the context of both forced on unforced choice, we tested for the presence of various potential dominant preferences. Respondents only received four choice sets, so the presence of dominance is based on a small fraction of the full fractional factorial design implying that the presence of dominance may be overestimated (Scott 2002), and Lancsar and Louviere (2006) actually discourage

[3] Thanks to John Rose for clarifying this in an E-mail correspondence, January 2011.

testing for dominance when a fractional factorial design is used since conclusive statements cannot be made. With this in mind, we did observe some evidence of dominant preferences (Table 8) as a significant proportion of respondents consistently chose the cheapest option, status quo or alternative A or B. When respondents consistently chose either alternative A or B, there is evidence of heuristics being applied, whereas consistently choosing the cheaper alternative or the status quo may be a reflection of true (lexicographic) preferences.

It is likely that the strong preference for the cheapest alternative to some degree is an expression of objections to the introduction of user fees for a health care service which has previously been free of charge. This objection is expressed either by way of choosing the cheapest of the alternatives (if forced to choose) or by opting out (in unforced choices). It should be noted that the strong reactions against the cost attribute observed in this study may be very context specific and the non-compensatory decision making entails that it can be problematic to introduce a cost attribute in DCEs in contexts where strong reactions against price is expected. If the high proportion of respondents who chose the status quo option reflects that respondents' choosing a hypothetical alternative are those who do not mind paying for primary care (because the status quo alternative is the only alternative always free of charge), results may not be generalisable to situations where the status quo has a positive cost. However, additional analyses including a dummy variable for a positive cost attribute did not show any statistically significant effect of this regressor on choice indicating that this concern may not be warranted.

Why such a large proportion of respondents choose status quo in the unforced choice cannot be verified. We could be dealing with true preferences for the current GP. This hypothesis is supported by the fact that there is a general satisfaction with current GPs amongst those who exhibit this type of dominant preference. The large proportion may also be explained by the endowment effect on experience, i.e. that respondents chose the alternatives of which they have experience. Recent DCE studies have indeed found evidence of significant endowment effects in health care (Neuman et al. 2010, Ryan and Ubach 2003). Consistent choice of current GP may also be explained by some degree of status quo bias, where respondents are choosing status quo consistently in order to reduce cognitive burden. This is in accordance with Boxall et al. (2009), and Dhar (1996) who observed that more respondents chose the status quo/opt out option when choices became more complex. That a higher proportion of respondents (although not statistically significant) consistently choose status quo when the cost attribute is introduced supports this finding.

As discussed above we cannot verify whether the presence of the aforementioned dominant preference structures is a result of true (lexicographic) preferences or heuristics. What we can conclude is that dominant preferences for alternative A or B is a clear documentation of heuristics being applied. The observation that some respondents, when they do not have the option of opting out or choosing the cheaper alternative, tend to consistently go for choice A or choice B suggests that a significant proportion (over 20 percent) of the respondents tend to use heuristics. Such respondents may indeed be consistently opting for lower user fees or status quo purely as a means of lessening the cognitive burden of choosing.

We have observed that the inclusion of a cost attribute in DCEs tends to change underlying choice behaviour and consequently the elicited preference structure. The observed change in preferences due to the inclusion of the cost attribute may be caused by lexicographic preference structures affecting scale and in some instances affecting the statistical significance of other attributes. We also demonstrate some evidence of a

change in the ranking of attributes. Finally, the cost attribute may induce respondents to use heuristics. Inclusion of a cost attribute in DCEs allows us to estimate MWTP in order to inform on welfare implications of programmes. Analysts should however be wary of the external validity of these estimates, especially if the programmes do not actually involve out of pocket payments at the point of purchase. Future research should explore the impact of the cost attribute on preference structures in different health programme contexts, in order to verify the extent of the problem.

8 Appendix

Table AI. Respondent Characteristics (% of respondents)

	DCE with user fee	DCE without user fee
Age (years)	41.77	41.90
Male	52.65	46.70
Higher education	52.17	56.48
High income (> 600.000 DKK / 80.628 EUR)	30.66	27.51
Satisfied with their GP	89.12	89.24
Consider to change GP	16.01	15.25
Long term relationship with GP (> 5 years)	62.42	56.88
Heavy user (> 8 visits within the last year)	6.51	7.73
Number of respondents	737	698

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